Current Drug Targets 2014 vol.15 N10, pages 956-964

β-adrenergic over-stimulation and cardio-myocyte apoptosis: Two receptors, one organelle, two fates?

Branco A., Moreira A., Cunha-Oliveira T., Couto R., Sardão V., Rizvanov A., Palotás A., Oliveira P.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2014 Bentham Science Publishers. Neuro-hormonal regulation of cardiac function via cathecol-amines results in increased heart rate and contractility. A persistent adrenergic tone, however, is an insult to the heart, affecting its regular homeostasis, altering morphology and gene expression patterns, as well as inducing apoptosis of cardio-myocytes. At the same time as being the main oxygen consumers, mitochondria are also key to the energy production required for the heart to maintain its vital functions and to integrate a series of signaling pathways that define the life and death of the cell. As β-adrenergic receptors (β-AR) orchestrate multiple biochemical events that can either trigger or inhibit cell death, mitochondria can act as a referee in the entire process. In fact, β-AR subtypes β1 and β2 activate various down-stream pathways which differently modulate intracellular calcium levels and production of mitochondrial reactive oxygen species (ROS). The delicate balance between an adaptive (cardio-protective) response resulting in increased contractility and activation of survival pathways, vs. cell death caused by calcium and ROS-induced mitochondrial disruption, along with evidence of their clinical and potential therapeutic translations, are reviewed in this communication.

Keywords

Apoptosis, Calcium, Cardio-myocyte, Mitochondria, Oxidative stress, β-adrenergic receptors